

Amendment

U.S. Patent Application No. 10/678,636

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Original) A method of suspending a well comprising the steps of:
providing a first barrier in the well;
verifying the integrity of the first barrier;
thereafter providing at least a second barrier in the well above the first barrier defining a space between the first and second barriers; and,
verifying the integrity of the second barrier, the method characterised in that the first and second barriers are below the depth of a lowermost end of a completion string when the completion string is installed in the well and remain in position while the well is suspended.
2. (Original) A method of suspending a well according to claim 1 wherein the step of verifying the integrity of the second barrier further comprises the step of measuring the pressure in the space between the first and second barriers.
3. (Currently Amended) A method of suspending a well according to claim 1 wherein at least one of the first barrier and~~[[/or]]~~ the second barrier~~[(s)]~~ is~~[[/are]]~~ selected from the group consisting of: a cement plug~~[(;)]~~, an unperforated liner~~[(;)]~~, a section of unperforated casing~~[(;)]~~, a liner top valve~~[(;)]~~, a bridge plug~~[(;)]~~, a straddle~~[(;)]~~, an expandable plug~~[(;)]~~, a disappearing plug~~[(;)]~~, a rupture disc~~[(;)]~~, or and an inflatable plug packer.
4. (Currently Amended) A method of suspending a well according to claim 1 wherein at least one of the first barrier and~~[[/or]]~~ the second barrier~~[(s)]~~ ~~comprise(s)~~ comprises a combination of a physical device, a means for securing the position of the physical device, and a sealing means.

Amendment

U.S. Patent Application No. 10/678,636

5. (Currently Amended) A method of suspending a well according to claim 4 wherein the sealing means is selected from the group consisting of: a ball valve[[:]], a flapper valve[[:]], a sliding sleeve[[:]], a pressure cycle plug[[:]], a wireline retrievable plug[[:]], a rupture disc[[:]], a formation isolation device[[:]], a shear disc[[:]], and[[/or]] a pump open device.

6. (Original) A method of suspending a well according to claim 4 wherein the sealing means is positioned distally from the physical device.

7. (Currently Amended) A method of suspending a well according to claim 1, further comprising the step of installing at least one of a first liner hanger and[[/or]] a second liner hanger in the well.

8. (Currently Amended) A method of suspending a well according to claim 7 wherein at least one of the first barrier and[[/or]] the second barrier are is provided within at least one of the first liner hanger and[[/or]] the second liner hanger.

9. (Currently Amended) A method of suspending a well according to claim 1 further comprising the step of installing at least one of a first liner and[[/or]] a second liner in the well.

10. (Currently Amended) A method of suspending a well according to claim 9 wherein at least one of the first barrier and[[/or]] the second barrier are is provided within at least one of the first liner and[[/or]] the second liner.

11. (Currently Amended) A method of suspending a well according to claim 1 wherein the well includes at least one casing string and at least one of the first barrier and[[/or]] the second barriers are barrier is provided within the at least one casing string.

12. (Original) A method of completing a well, comprising the steps of:

Amendment

U.S. Patent Application No. 10/678,636

providing a first barrier in the well;

verifying the integrity of the first barrier;

thereafter providing at least a second barrier in the well above the first barrier defining a space between the first and second barriers;

verifying the integrity of the second barrier;

relying on the first and second barriers to provide well control during installation of a completion string in the well, the completion string having a lowermost end; and,

installing a production flow control device on the well for regulating the flow of fluids through the well, the method characterised in that the first and second barriers are below the depth of the lowermost end of the completion string when the completion string is installed in the well.

13. (Original) A method of completing a well according to claim 12 wherein the step of verifying the integrity of the second barrier further comprises the step of measuring the pressure in the space between the first and second barriers.

14. (Currently Amended) A method of completing a well according to claim 12 wherein at least one of the first barrier and~~[[/or]]~~ the second barrier~~[(s)]~~ is~~[[/are]]~~ selected from the group consisting of: a cement plug~~[(;)]~~, an unperforated liner~~[(;)]~~, a section of unperforated casing~~[(;)]~~, a liner top valve~~[(;)]~~, a bridge plug~~[(;)]~~, a straddle~~[(;)]~~, an expandable plug~~[(;)]~~, a disappearing plug~~[(;)]~~, a rupture disc~~[(;)]~~, or and an inflatable plug packer.

15. (Currently Amended) A method of completing a well according to claim 12 wherein at least one of the first barrier and~~[[/or]]~~ the second barrier~~[(s)]~~ comprise(s) comprises a combination of a physical device, a means for securing the position of the physical device, and a sealing means.

16. (Currently Amended) A method of completing a well according to claim 12 wherein the sealing means is selected from the group consisting of: a ball valve~~[(;)]~~, a flapper valve~~[(;)]~~, a

Amendment

U.S. Patent Application No. 10/678,636

sliding sleeve[[]], a pressure cycle plug[[]], a wireline retrievable plug[[]], a rupture disc[[]], a formation isolation device[[]], a shear disc[[]], and[[/or]] a pump open device.

17. (Original) A method of completing a well according to claim 15 wherein the sealing means is positioned distally from the physical device.

18. (Currently Amended) A method of completing a well according to claim 12, further comprising the step of installing at least one of a first liner hanger and[[/or]] a second liner hanger in the well.

19. (Currently Amended) A method of completing a well according to claim 18 wherein at least one of the first barrier and[[/or]] the second barrier are is provided within at least one of the first liner hanger and[[/or]] the second liner hanger.

20. (Currently Amended) A method of completing a well according to claim 12 further comprising the step of installing at least one of a first liner and[[/or]] a second liner in the well.

21. (Currently Amended) A method of completing a well according to claim 20 wherein at least one of the first barrier and[[/or]] the second barrier are is provided within at least one of the first liner and[[/or]] the second liner.

22. (Currently Amended) A method of completing a well according to claim [[1]] 12 wherein the well includes at least one casing string and at least one of the first barrier and[[/or]] the second barriers are barrier is provided within the at least one casing string.

23. (Original) A method of completing a well according to claim 12 wherein the method further comprises the step of installing a tubing spool in the well-head prior to the step of installing the completion string in the well.

Amendment

U.S. Patent Application No. 10/678,636

24. (Original) A method of completing a well according to claim 12 wherein the production flow control device is a christmas tree.

25. (Original) A method of completing a well according to claim 24 wherein the christmas tree is a horizontal christmas tree.

26. (Currently Amended) A method of completing a well according to claim 25 wherein the horizontal christmas tree includes having a body, the completion string terminates at its upper end in and is suspended from a tubing hanger, and the method further comprises the step of forming an assembly comprising the horizontal christmas tree and the tubing hanger by landing and locking the tubing hanger in the body of the horizontal christmas tree prior to the step of installing the production flow control device on the well.

27. (Original) A method of completing a well according to claim 26 further comprising the step of installing the assembly on the well in a single operation.

28. (Original) A method of completing a well according to claim 24 wherein the christmas tree is a vertical christmas tree.

29. (Currently Amended) A method of working over a completed well, the completed well including a production flow control device and a completion string installed in the well-bore, the completion string having an uppermost end terminating in a tubing hanger from which the completion string is suspended and a lowermost end, the method comprising the steps of:

providing a first barrier in the well;

verifying the integrity of the first barrier;

thereafter providing at least a second barrier in the well above the first barrier defining a space between the first and second barriers;

Amendment

U.S. Patent Application No. 10/678,636

verifying the integrity of the second barrier;

relying on the first and second barriers to provide well control during at least one of removal of the tubing hanger, completion string, and[[/or]] production flow control device from the well; and,

the method characterised in that the first and second barriers are below the depth of the lowermost end of the completion string when the completion string is installed in the well.

30. (Original) A method of working over a completed well according to claim 29 wherein the step of verifying the integrity of the second barrier further comprises the step of measuring the pressure in the space between the first and second barriers.

31. (Currently Amended) A method of working over a completed well according to claim 29 wherein at least one of the first barrier and[[/or]] the second barrier[[(s)]] is[[/are]] selected from the group consisting of: a cement plug[[;]], an unperforated liner[[;]], a section of unperforated casing[[;]], a liner top valve[[;]], a bridge plug[[;]], a straddle[[;]], an expandable plug[[;]], a disappearing plug[[;]], a rupture disc[[;]], or and an inflatable plug packer.

32. (Currently Amended) A method of working over a completed well according to claim 29 wherein at least one of the first barrier and[[/or]] the second barrier[[(s)]] comprise(s) comprises a combination of a physical device, a means for securing the position of the physical device, and a sealing means.

33. (Currently Amended) A method of working over a completed well according to claim 32 wherein the sealing means is selected from the group consisting of: a ball valve[[;]], a flapper valve[[;]], a sliding sleeve[[;]], a pressure cycle plug[[;]], a wireline retrievable plug[[;]], a rupture disc[[;]], a formation isolation device[[;]], a shear disc; and[[/or]] a pump open device.

34. (Original) A method of working over a completed well according to claim 32

Amendment

U.S. Patent Application No. 10/678,636

wherein the sealing means is positioned distally from the physical device.

35. (Currently Amended) A method of working over a completed well according to claim 29, further comprising the step of installing at least one of a first liner hanger and~~[[/or]]~~ a second liner hanger in the well.

36. (Currently Amended) A method of working over a completed well according to claim 35 wherein at least one of the first barrier and~~[[/or]]~~ the second barrier ~~are~~ is provided within at least one of the first liner hanger and~~[[/or]]~~ the second liner hanger.

37. (Currently Amended) A method of working over a completed well according to claim 29 further comprising the step of installing at least one of a first and~~[[/or]]~~ a second liner in the well.

38. (Currently Amended) A method of working over a completed well according to claim 37 wherein at least one of the first barrier and~~[[/or]]~~ the second barrier ~~are~~ is provided within at least one of the first liner and~~[[/or]]~~ the second liner.

39. (Currently Amended) A method of working over a completed well according to claim 29 wherein the well includes at least one casing string and at least one of the first barrier and~~[[/or]]~~ the second barrier~~[[s]]~~ ~~are~~ is provided within the at least one casing string.

40. (Original) A method of working over a completed well according to claim 29 wherein the method further comprises the step of installing a tubing spool on the well and thereafter installing the tubing hanger of the completion string in the tubing spool.

41. (Original) A method of working over a completed well according to claim 29 wherein the production flow control device is a christmas tree.

Amendment

U.S. Patent Application No. 10/678,636

42. (Original) A method of working over a completed well according to claim 41 wherein the christmas tree is a horizontal christmas tree.

43. (Currently Amended) A method of working over a completed well according to claim 29 41 wherein the horizontal christmas tree includes a body and the method further comprises the step of removing at least one of the tubing hanger and[[/or]] the completion string from the body of the horizontal christmas tree by unlocking the tubing hanger from the body of the horizontal christmas tree.

44. (Original) A method of working over a completed well according to claim 42 wherein the horizontal christmas tree includes a body and the method further comprises the step of removing the horizontal christmas tree and the completion string as an assembly.

45. (Original) A method of working over a completed well according to claim 41 wherein the christmas tree is a vertical christmas tree.

46. (Currently Amended) A method of working over a completed well according to claim 29 further comprising the step of relying on the first and second barriers to provide well control until at least one of the tubing hanger, the completion string and[[/or]] the production flow control device are is reinstalled in or on the well.

47. (Original) A suspended well comprising:

a well bore having an uppermost end;

a well head installed towards the uppermost end of the well-bore; and,

at least a first and a second independently verified barrier positioned in a spaced-apart relationship in the well bore defining a space therebetween characterised in that the first and second barriers are below the anticipated depth of a lowermost end of a completion string when the

Amendment

U.S. Patent Application No. 10/678,636

completion string is installed in the well.

48. (Original) A suspended well according to claim 47 further comprising a pressure measuring means for generating a signal indicative of the pressure in the space between the first and second barriers.

49. (Original) A suspended well according to claim 48 further comprising a signal receiving means for receiving the signal generated by the pressure measuring means.

50. (Original) A suspended well according to claim 49 further comprising a means for transmitting the signal from the pressure measuring means to the pressure signal receiving means.

51. (Original) A suspended well according to claim 48 wherein the pressure measuring means is a transducer.

52. (Original) A suspended well according to claim 47, wherein the well is a sub-sea well, a land well or a platform well.

53. (Currently Amended) A suspended well according to claim 47 wherein at least one of the first barrier and[/or] the second barrier[[s]] is[[/are]] selected from the group consisting of: a cement plug[[;]], an unperforated liner[[;]], a section of unperforated casing[[;]], a liner top valve[[;]], a bridge plug[[;]], a straddle[[;]], an expandable plug[[;]], a disappearing plug[[;]], a rupture disc[[;]], or and an inflatable plug packer.

54. (Currently Amended) A suspended well according to claim 47 wherein at least one of the first barrier and[/or] the second barrier[[s]] comprise(s) comprises a combination of a physical device, a means for securing the position of the physical device, and a sealing means.

Amendment

U.S. Patent Application No. 10/678,636

55. (Currently Amended) A suspended well according to claim 54 wherein the sealing means is selected from the group consisting of: a ball valve[[]], a flapper valve[[]], a sliding sleeve[[]], a pressure cycle plug[[]], a wireline retrievable plug[[]], a rupture disc[[]], a formation isolation device[[]], a shear disc[[]], and[[/or]] a pump open device.

56. (Original) A suspended well according to claim 54 wherein the sealing means is positioned distally from the physical device.

57. (Currently Amended) A suspended well according to claim 47, further comprising at least one of a first liner hanger and[[/or]] a second liner hanger installed in the well.

58. (Currently Amended) A suspended well according to claim 57 wherein at least one of the first barrier and[[/or]] the second barrier are is positioned within at least one of the first liner hanger and[[/or]] the second liner hanger.

59. (Currently Amended) A suspended well according to claim 47 further comprising at least one of a first liner and[[/or]] a second liner installed in the well.

60. (Currently Amended) A suspended well according to claim 59 wherein at least one of the first barrier and[[/or]] the second barrier are is positioned within at least one of the first liner and[[/or]] the second liner.

61. (Currently Amended) A suspended well according to claim 47 wherein the well includes at least one casing string and at least one of the first barrier and[[/or]] the second barrier[[s]] are is provided within the at least one casing string.

62. (Original) A completed well comprising:
a well bore having an uppermost end;

Amendment

U.S. Patent Application No. 10/678,636

a well head installed towards the uppermost end of the well-bore;

a production flow control device on or above the well-head;

a completion string installed in the well-bore and having a lowermost end; and,

at least a first and a second independently verified barrier positioned in a spaced-apart relationship in the well bore defining a space between the first and second barriers, characterised in that the first and second barriers are below the lowermost end of the completion string.

63. (Original) A completed well according to claim 62 further comprising a pressure measuring means for generating a signal indicative of the pressure in the space between the first and second barriers.

64. (Original) A completed well according to claim 62 further comprising a signal receiving means for receiving the signal generated by the pressure measuring means.

65. (Original) A completed well according to claim 62 further comprising a means for transmitting the signal from the pressure measuring means to the pressure signal receiving means.

66. (Original) A completed well according to claim 63 wherein the pressure measuring means is a transducer.

67. (Original) A completed well according to claim 63, wherein the production flow control device is a horizontal or vertical christmas tree.

68. (Original) A completed well according to claim 62 further comprising a tubing spool installed in the well-head.

69. (Original) A completed well according to claim 62, wherein the well is a sub-sea well, a land well or a platform well.

Amendment

U.S. Patent Application No. 10/678,636

70. (Currently Amended) A completed well according to claim 62 wherein at least one of the first barrier and[[/or]] the second barrier[[s]] is[[/are]] selected from the group consisting of: a cement plug[[;]], an unperforated liner[[;]], a section of unperforated casing[[;]], a liner top valve[[;]], a bridge plug[[;]], a straddle[[;]], an expandable plug[[;]], a disappearing plug[[;]], a rupture disc[[;]], or and an inflatable plug packer.

71. (Currently Amended) A completed well according to claim 62 wherein at least one of the first barrier and[[/or]] the second barrier[[s]] comprise(s) comprises a combination of a physical device, a means for securing the position of the physical device, and a sealing means.

72. (Currently Amended) A completed well according to claim 71 wherein the sealing means is selected from the group consisting of: a ball valve[[;]], a flapper valve[[;]], a sliding sleeve[[;]], a pressure cycle plug[[;]], a wireline retrievable plug[[;]], a rupture disc[[;]], a formation isolation device[[;]], a shear disc[[;]], and[[/or]] a pump open device.

73. (Original) A completed well according to claim 71 wherein the sealing means is positioned distally from the physical device.

74. (Currently Amended) A completed well according to claim 62, further comprising at least one of a first liner hanger and[[/or]] a second liner hanger installed in the well.

75. (Currently Amended) A completed well according to claim 74 wherein at least one of the first barrier and[[/or]] the second barrier are is positioned within at least one of the first liner hanger and[[/or]] the second liner hanger.

76. (Currently Amended) A completed well according to claim 62 further comprising at least one of a first liner and[[/or]] a second liner installed in the well.

Amendment

U.S. Patent Application No. 10/678,636

77. (Currently Amended) A completed well according to claim 76 wherein at least one of the first barrier and[[/or]] the second barrier are is positioned within at least one of the first liner and[[/or]] the second liner.

78. (Currently Amended) A completed well according to claim 62 wherein the well includes at least one casing string and at least one of the first barrier and[[/or]] the second barrier[[s]] are is provided within the at least one casing string.

79. (Canceled)

80. (Original) A completed well according to claim 62 wherein the production flow control device is a christmas tree.

81. (Original) A completed well according to claim 80 wherein the christmas tree is a horizontal christmas tree.

82. (Original) A completed well according to claim 80 wherein the christmas tree is a vertical christmas tree.

83. (Currently Amended) A dual barrier system for use in suspending, completing or working over a well, the dual barrier system comprising:

a first barrier and a second body barrier positioned in a spaced-apart relationship in the well and defining a space between the first and second barriers;

a pressure measuring means for generating a signal indicative of the pressure in the space between the first and second barriers;

a pressure signal receiving means for receiving the signal generated by the pressure measuring means; and,

Amendment

U.S. Patent Application No. 10/678,636

a means for transmitting the signal from the pressure measuring means to the pressure signal receiving means;

wherein the first and second barriers provide a barrier to the flow of hydrocarbons through the bore of the well while the well is suspended, completed or worked over.

84. (Original) A dual barrier assembly according to claim 83, wherein the pressure measuring means is a transducer.

85. (Currently Amended) A dual barrier assembly according to claim 83 wherein at least one of the first barrier and[[/or]] the second barrier[[s]] is[[/are]] selected from the group consisting of: a cement plug[[;]], an unperforated liner[[;]], a section of unperforated casing[[;]], a liner top valve[[;]], a bridge plug[[;]], a straddle[[;]], an expandable plug[[;]], a disappearing plug[[;]], a rupture disc[[;]], or and an inflatable plug packer.

86. (Currently Amended) A dual barrier assembly according to claim 83 wherein at least one of the first barrier and[[/or]] the second barrier[[s]] comprise(s) comprises a combination of a physical device, a means for securing the position of the physical device, and a sealing means.

87. (Currently Amended) A dual barrier assembly according to claim 86 wherein the sealing means is selected from the group consisting of: a ball valve[[;]], a flapper valve[[;]], a sliding sleeve[[;]], a pressure cycle plug[[;]], a wireline retrievable plug[[;]], a rupture disc[[;]], a formation isolation device[[;]], a shear disc[[;]], and[[/or]] a pump open device.

88. (Original) A dual barrier assembly according to claim 86 wherein the sealing means is positioned distally from the physical device.

89. (Currently Amended) A dual barrier assembly according to claim 83 wherein the well further comprises at least one of a first liner hanger and[[/or]] a second liner hanger installed in

Amendment

U.S. Patent Application No. 10/678,636

the well and at least one of the first barrier and[[/or]] the second barrier are is positioned within at least one of the first liner hanger and[[/or]] the second liner hanger.

90. (Currently Amended) A dual barrier assembly according to claim 83 wherein the well further comprises at least one of a first liner and[[/or]] a second liner installed in the well and at least one of the first barrier and[[/or]] the second barrier are is positioned within at least one of the first liner and[[/or]] the second liner.

91. (Currently Amended) A dual barrier assembly according to claim 83 wherein the well further comprises at least one casing string and at least one of the first barrier and[[/or]] the second barrier[[s]] are is provided within the at least one casing string.

92. (Original) A method of completing a sub-sea well using a horizontal christmas tree for production flow control, the horizontal christmas tree having a body, the method comprising the steps of:

forming an assembly by installing a completion string terminating at its upper end in and suspended from a tubing hanger in the body of the horizontal christmas tree; and,

running the assembly to the sub-sea well, the method characterised in that the tubing hanger and the horizontal christmas tree are above the water-line during the step of forming the assembly.

93. (Original) A method of completing a sub-sea well using a horizontal christmas tree for production flow control according to claim 92, wherein the step of forming the assembly further comprises the steps of landing and locking the tubing hanger in the body of the christmas tree.

94. (Original) A method of completing a sub-sea well using a horizontal christmas tree for production flow control according to claim 93, wherein the method further comprises the step of verifying the integrity of the completed assembly above the water line.

Amendment

U.S. Patent Application No. 10/678,636

95. (Original) A method of completing a sub-sea well using a horizontal christmas tree for production flow control according to claim 94, wherein the step of verifying the integrity comprises the step of verifying hydraulic and electrical interfaces between the tubing hanger and the body of the christmas tree.

96. (Original) A method of completing a sub-sea well using a horizontal christmas tree for production flow control according to claim 94, wherein the step of verifying the integrity further comprises the step of verifying the pressure integrity of the assembly.

97. (Original) A method of completing a sub-sea well using a horizontal christmas tree for production flow control according to claim 92, wherein the step of running the assembly to the well head comprises the step of using a lower-riser package.

98. (New) A method comprising:
coupling a tubing string with a Christmas tree above water; and
landing the Christmas tree on a subsea wellhead.

99. (New) The method of claim 98, wherein coupling the tubing string with the Christmas tree comprises installing a tubing hanger on an uppermost joint of the tubing string and locking the tubing hanger to the Christmas tree.

100. (New) The method of claim 98, further comprising:
running the Christmas tree, the tubing hanger, and the tubing string open-water to a well extending from the subsea wellhead.

101. (New) The method of claim 100, wherein running the Christmas tree, the tubing hanger, and the tubing string further comprises running the Christmas tree, the tubing hanger, and the tubing string without a blow-out preventer.

Amendment

U.S. Patent Application No. 10/678,636

102. (New) The method of claim 98, wherein coupling the tubing string with the Christmas tree comprises installing a tubing hanger on an uppermost joint of the tubing string, locking the tubing hanger in a tubing spool, and attaching the tubing spool to the Christmas tree.

103. (New) A method comprising:
coupling a tubing string with a tubing hanger above water;
landing the tubing hanger on a subsea wellhead; and
landing a Christmas tree on the subsea wellhead.

104. (New) The method of claim 103, further comprising:
latching the tubing hanger to the Christmas tree.

105. (New) The method of claim 103, further comprising:
latching the tubing hanger to the wellhead.

106. (New) The method of claim 103, wherein landing the tubing hanger on the subsea wellhead further comprises landing the tubing hanger on the subsea wellhead via a tubing spool and latching the tubing hanger to the tubing spool.